We claim:

1. A device for guiding a charged particle beam comprising a superconducting nano-channel consisting essentially of a superconducting material in the form of a tube having a proximal end, a distal end, and a bend disposed between said proximal end and said distal end.

2. The device as recited in claim 1, wherein said bend is between zero degrees, and about 180 degrees.

3. The device as recited in claim 1, wherein said bend is about 90 degrees.

4. The device as recited in claim 1, further comprising an electron-transparent window sealed to said distal end of said tube.

5. The device as recited in claim 4, wherein said window is substantially planar.

6. The device as recited in claim 4, wherein said window is a semispherical end cap.

7. The device as recited in claim 4, further comprising an electron beam emitter sealed to said proximal end of said tube.

8. The device as recited in claim 7, wherein said electron beam emitter comprises a first superconducting nanotube.

9. The device as recited in claim 7, wherein said tube, said window, and said electron beam emitter form an ultra-high vacuum region.

10. A device for guiding a charged particle beam comprising a first superconducting nano-channel formed by a substrate, a first area of superconducting material coated on said substrate and having a first edge, a second area of superconducting material coated on said substrate and having a second edge, wherein said first edge of said first area of superconducting material and said second edge of said second area of superconducting material are substantially parallel.

11. The device as recited in claim 10, further comprising a first area of non-conductive material disposed on said first area of superconducting material, and a second area of non-conductive material disposed on said second area of superconducting material.

12. The device as recited in claim 11, further comprising a third area of superconducting material disposed on said first area of non-conductive material, and a fourth area of superconducting material disposed on said second area of non-conductive material.

13. The device as recited in claim 10, further comprising a second superconducting nano-channel formed by said substrate, a third area of superconducting material coated on said substrate and having a third edge, a fourth area of superconducting material coated on said substrate and having a fourth edge, wherein said third edge of third area of superconducting material and said fourth edge of fourth area of superconducting material are substantially parallel.

14. A device for guiding a charged particle beam comprising a superconducting nano-channel formed by a plurality of nano-scale superconducting rods disposed around a central region.

15. The device as recited in claim 14, wherein said plurality of nano-scale superconducting rods is comprised of four rods.

16. The device as recited in claim 14, wherein said plurality of nano-scale superconducting rods is comprised of six rods.

17. The device as recited in claim 16, further comprising a seventh nano-scale superconducting rod disposed in said central region.

18. The device as recited in claim 14, wherein said rods have a substantially circular cross section.

19. A device for guiding a charged particle beam comprising a superconducting nano-channel comprising a first split and a second split disposed parallel to the central axis of said nano-channel, said first and second splits forming a first section and a second section of said nano-channel.

20. The device as recited in claim 19, wherein said superconducting nano-channel is a superconducting nano-cylinder.

21. The device as recited in claim 20, wherein said first split and said second split are parallel.

22. The device as recited in claim 20, wherein said first section and said second sections are half-cylinders.

23. The device as recited in claim 22, wherein said first section comprises a first inner surface, and said second section comprises a second inner surface, and wherein said first section comprise a first layer of conductive material disposed on said first inner surface, and said second section comprise a second layer of conductive material disposed on said second inner surface.

24. The device as recited in claim 20, wherein said first split and said second split are helical.